

Jiro TANAKA* & Mitsuo CHIHARA*: **Taxonomic study of
the Japanese crustose brown algae (3) *Ralfsia*
(*Ralfsiaceae, Ralfsiales*) (Part 2)****

田中次郎*・千原光雄*: 日本産殼状褐藻の分類学的研究 (3)
イソガワラ属 (第2部)

4) ***Ralfsia integrata*** Hollenberg, J. Phycol. 5: 295 (1969).

Thallus crustose, flat and expanded, epilithic or epiphytic, medium to dark brown, circular in outline when young, often confluent with other thalli, attaining up to 3 cm or more in diameter in mature thallus, firmly attached to the substratum without rhizoids; the surface of thallus somewhat undulate; basal layer indistinct, consisting of several horizontal rows of cells, whose cells are 12-15 μm high and 1.5-2 times as broad as high; erect filaments arising from a basal layer, often curving upwards, branched, tapering towards the surface, firmly adjoined with one another to form a pseudoparenchymatous tissue, having upper cells that are 5-6 μm broad and 1.5-2.5 times as long as wide; hairs in tuft arising from the median portion of thallus; chloroplasts single per cell, plate-shaped or parietal, located in the upper part of the cell; unicellular sporangia abundant, borne in a large sorus in the central portion of thallus, clavate to obovate, mostly 90-130 μm long and 15-25 μm broad, sessile; paraphyses clavate, slender, 130-180 μm long, consisting of 8-12 cells, with its terminal cell being 7-8 μm broad and 1.3-1.7 times as long as wide; plurilocular reproductive organs unknown.

Habitat: Growing on rocks or pebbles and also epiphytic on *Padina arborescens* as found at Shimoda, Shizuoka-ken, in shallow tide pools or in still water in the middle intertidal zone.

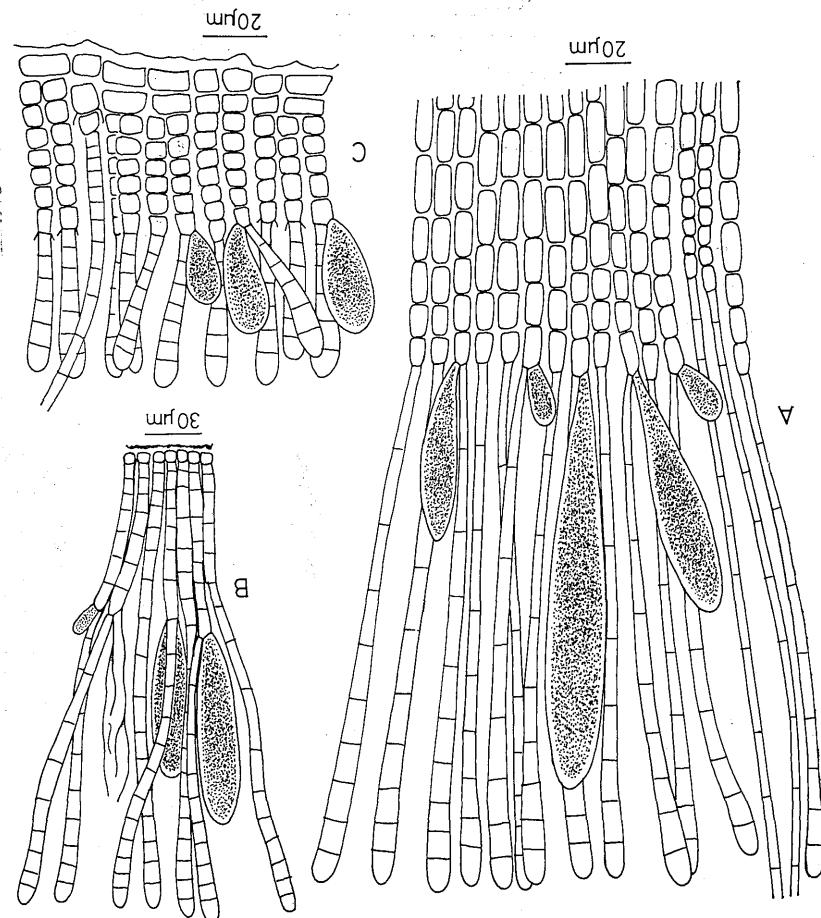
Type locality: Orange County, California, U.S.A.

Geographical distribution: California to Mexico. Probably common in the temperate regions along the Pacific coast of Japan.

* Institute of Biological Sciences, The University of Tsukuba, Sakura-mura, Ibaraki-ken 305. 筑波大学生物科学系。

** Continued from Journ. Jap. Bot., 55: 225-236 (1980). Contributions from the Shimoda Marine Research Center, The University of Tsukuba, no. 370.

Fig. 1. A. *Ralfsia integrifolia*. Longitudinal section of the thallus with unicellular sporangia, showing long sporangiostila and long paraplyxes, and also, long and slender cortical cells. B. *Ralfsia borealis*. Longitudinal section of the thallus with unicellular sporangia, showing erect filaments being separated. C. *Ralfsia tenuis*. Longitudinal section of the thallus with unicellular sporangia, showing globular sporangia, showing globular sporangia and collar-like, remnant.



In the light of the original description and illustration given by Hollemburg
6, 1977 (TKB 1324); Hachijo-jima, Tokyo, May 23, 1978 (TKB 1325).
(TKB 1322); the same, July 30, 1977 (TKB 1323); Ikenoura, Kochi-ken, Mar.
Representative specimens examined: Shimoda, Shizuoka-ken, May 4, 1972
(TKB 1322); Hachijo-jima, Tokyo, May 23, 1978 (TKB 1325).

(1969), based on the specimens from California, we have recognized the present alga to agree with *Ralfsia integra*. We have examined the holotype specimen deposited in the Herbarium of Smithsonian Institution (USNH 61158) and confirmed that the species has long unilocular sporangia and long paraphyses consisting of 8-12 cells, a large sorus in the central part of thallus and upper cortical cells being long (about 2 times as long as wide).

In the localities concerned in the present study, this species is quite common and, especially, it was found abundantly growing epiphytically on *Padina arborescens* at Shimoda and its vicinity, Izu Peninsula. It is easily found when growing epiphytically, but when growing on rocks, it is not easy for us to distinguish it from other members of *Ralfsia*. In Japan it is most like *R. verrucosa* and also *R. expansa*. The present alga differs from *R. verrucosa* by having a thinner thallus and longer sporangia and by having a sorus covering a large area in the central portion of thallus. *Ralfsia integra* also differs from *R. expansa* by having longer cortical cells, which is a character separating this species from almost all other members of *Ralfsia*.

5) *Ralfsia bornetii* Kuckuck, Wiss. Meeresunters. N.F. 1: 244, fig. 14 (1894); Kylin, Lunds Univ. Årsskr. N.F. Avd. 2. 43(4) : 44, fig. 38-E, F (1947).

Thallus crustose, expanded, epilithic, circular in outline when young, later becoming irregular, mostly 2-3 mm and up to 5 mm in diameter, 200-550 μm thick when matured, often confluent with other thalli, medium dark brown in nature, olive-colored in formalin preserved specimens; the surface of the thallus rough and somewhat gelatinous; thallus consisting of two parts; basal layer composed of 1-2 rows of cells, which are 10-16 μm broad and 0.4-0.9 times as long as wide; upper layer composed of erect filaments which arise from the basal layer, loosely adjoined with one another and easily separated with pressure; erect filament simple, consisting of 15-25 cells which are 7-9 μm broad and 0.8-2 times as long as wide; chloroplast single per cell, plate-shaped; unilocular sporangia arising from the supporting cell of paraphyses soon after the formation of paraphyses, clavate to obovate, mostly 80-100 μm , up to 160 μm long, 16-28 μm broad when matured; paraphyses clavate, arising terminally from an erect filament, consisting of 6-10 cells, with its terminal cell being 7-8 μm broad and 1.2-1.5 times as long as wide, and with its basal cell being 3.5-4.5 μm broad and mostly 6-8 times as long as wide; plurilocular reproductive organs not observed, probably lacking in the crustose form.

Habitat: Growing on rocks or pebbles in the middle to the lower intertidal zone, often growing mixed together with *Ralfsia tenuis*.

Type locality: Helgoland, West Germany.

Geographical distribution: Germany and Sweden. Probably common on the Pacific coast of Japan. Many collections made from the Izu Peninsula.

Representative specimens examined: Kamakura, Kanagawa-ken, Jan. 19, 1977 (TKB 1330); Shimoda, Shizuoka-ken, Oct. 28, 1977 (TKB 1331).

The present alga belongs to the subgenus *Stragularia* (sensu De Toni, 1895) because of having the loosely adjoined erect filaments which are easily crushed out with pressure. It is very similar, if not identical, to *Ralfsia bornetii* Kuckuck. They have unilocular sporangia and paraphyses both similar in size and in shape in these two algae. However, there are some different features discernible between the two: according to Kuckuck (1894), *R. bornetii* has a thallus consisting of firmly adjoined erect filaments which are about 200 μm thick, whereas the present alga has thalli being more than 300-400 μm in thickness and consisting of loosely adjoined erect filaments, and, furthermore, according to Kuckuck, the erect filaments in *R. bornetii* consists of 6 cells, whereas those of ours consist of mostly 8-10 cells, a value being almost in agreement with that given by Kylin (1947) with his specimens from the west coast of Sweden, in which he finds the erect filaments consisting of 8-12 cells. Kuckuck also found his plant bearing plurilocular reproductive organs, but they have not been found in ours. As mentioned above, there are some disagreements between Kuckuck's and our specimens, but we consider, for the time being, this alga to be the same as *R. bornetii*.

Recently, the life history study of the Scytoniphonaceae has been extensively made and, as a result, some species of *Ralfsia*, including *R. clavata* and *R. bornetii*, previously placed in the subgenus *Stragularia*, are now known to be as a stage bearing unilocular sporangia in the life history of the Scytoniphonaceae. Considering this evidence, it would be possible to conceive *R. bornetii* and *R. tenuis* in Japan to be a generation of certain members of this family, which are widely distributed in our waters. As mentioned above, it might be unreasonable to include these algae in the Japanese flora of the Ralfsiales. However, it is more convenient to treat them as members of this algal group for the time being until their culture studies have been carried out.

6) *Ralfsia tenuis* Kylin, Lunds Univ. Årsskr. N.F. Avd. 2. 43(4) : 45. fig. 38-

C, D (1947); Lund, *Meddel. Grönland* 156: 78 (1959).

Ralfsia clavata Reinke, *Ber. Kommiss. Wiss. Unters. Deutsch. Meeres.* 6: 48 (1889); *Atlas. Deutsch. Meeresalg.*: 9. pls. 5-6. figs. 14-20 (1889).

Thallus thin crustose, expanded, epilithic, light to medium dark brown, circular in outline when young, later becoming irregular, with its margin becoming indefinite, attaining up to 1 cm in diameter and up to 150 μm thick when matured, attached to the substratum without rhizoids; thallus composed of a basal layer and an erect filament; a basal layer composed of a few rows of cells which are 10-15 μm broad and 6-10 μm high; an erect filament arising from a basal layer, loosely adjoined with one another, simple, slightly tapering toward the surface, sometimes curving, composed of 10-12 cells, that are 7-9 μm broad and 0.6-1.2 times as long as wide; hairs in small tuft, arising from a basal layer; chloroplast single per cell, plate-shaped; cell often containing many irregular shaped storage substances; unilocular sporangium globular, clavate or ellipsoidal, 40-65 μm long and 15-30 μm broad when matured; paraphyses long clavate up to 90 μm long, composed of 6-10 cells whose basal cell is often surrounded with a collar-like remnant; the terminal cell of paraphyses 7-8 μm broad and 1.0-1.4 times as long as wide; plurilocular reproductive organs not observed.

Habitat: Growing on rocks or pebbles in the upper and the middle intertidal zone, sometimes mixed together with *Pseudolithoderma subextensum*.

Type locality: Baltic Sea (as *Ralfsia clavata* Reinke).

Geographical distribution: Baltic Sea, east Greenland and Sweden. Probably common in Japan.

Representative specimens examined: Shimoda, Shizuoka-ken, Oct. 25, 1977 (TKB 1326); Kamakura, Kanagawa-ken, Jan. 19, 1977 (TKB 1327).

According to Reinke (1889) and Kylin (1947), this species is characterized by having a thin thallus, erect filaments loosely adjoined with one another, and globular-shaped unilocular sporangia. We have found the present alga to be identical with this species.

Ralfsia tenuis was first described as *R. clavata* by Reinke (1889) on the basis of the specimen collected from West Germany. Later, Kylin (1947) pointed out that this binomial was a homonym of *R. clavata* (Carmichael) Farlow (1881) and, consequently, he proposed a new name to the Reinke's alga, *Ralfsia tenuis* Kylin, which was followed by Lund (1959).

The illustrations of this species given by Kylin (1947), shows that hairs arise from the terminal cell of erect filaments in his Fig. 38, D, F. This kind of hair has not been found in any other species of *Ralfsia* that has been examined. In *Ralfsia*, hairs usually arise from cells situated at or near the basal or the median part of the thallus. It is likely that Kylin has made a mistake in illustrating this feature. Kylin (1947) has also drawn a fan-shaped structure as a plurilocular reproductive organ on the top of the erect filament in his figure 38, C. It should also be pointed out that this kind of organ has never been described in *Ralfsia*. Taking into consideration the recent cultural work on the Scytophionaceae, it might be assumed that it is a young sporophyte of a certain member of this algal family.

Ralfsia tenuis is similar to *R. clavata* (Carm.) Farl. and *R. bornetii* in having a small and thin thallus, erect filaments loosely adjoined with one another and clavate paraphyses. However, *R. tenuis* differs from these two by having shorter and more globular unilocular sporangia and having shorter paraphyses. This species grows often mixed with a species of *Pseudolithoderma* near Shimoda and its vicinity, Shizuoka-ken. They are superficially similar and sometimes it is not easy to distinguish them from each other. However, it can be distinguished from *Pseudolithoderma* by its color which is a much lighter shade of brown.

References

De Toni, J. B. 1895. Sylloge algarum. vol. 3. Fucoideae. 638 pp. Padua. Hollenberg, J. H. 1969. An account of the Ralfsiaceae (Phaeophyta) of California. J. Phycol. 5: 290-301. Kuckuck, P. 1894. Bemerkungen zur marinischen Algen-vegetation von Helgoland. I. Wiss. Meeresuntersuch. Biol. Anstalt auf Helgoland. N. F. 1: 225-263. Kylin, H. 1947. Die Phaeophyceen der schwedischen Westküste. Lunds Univ. Årsskr. N. F. Avd. 2. 43(4): 1-99. 61 figs. 18 pls. Lund, S. 1959. The marine algae of East Greenland. I. Taxonomical part. Meddel. om Grönland. 156: 1-247. 42 figs. Reinke, J. 1889. Atlas Deutscher Meeresalgen. Pt. 1. 34 pp. 25 pls. Berlin.

* * * * *

日本産殼状褐藻の分類学的研究の第三報で、イソガワラ科、イソガワラ属 *Ralfsia* の3種 *R. integra* Hollenberg, *R. bornetii* Kuckuck 及び *R. tenuis* Kylin について種の特徴を示す解剖図を添えて分類上の記述を行った。本報文で扱った3種はいずれも日本新産である。